Uva Wellassa University

ENHANCEMENT OF EFFICIENCY OF DYE SENSITIZED SOLAR CELLSBY COUPLING OF TWO DYES

Bachelor of Technology Dissertation

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Abstract

D-358 (Indoline) dye, black dye (triscarboxy-rutheniumterpyridine) [Ru4,4',4"-$(COOH)_3$-terpy)$(NCS)_3$] and their cocktails on ZnO films were studied by means of utilization as light harvesting electrodes in ZnO based photo-electrochemical cells. The conversion efficiency of organic dye based dye sensitized solar cells (DSSC) was improved by co-sensitization with dye. Because of the conversion efficiency of the DSSC depends entirely on the sensitizing ability of dyes; extensive efforts have been made to develop highly efficient dyes for panchromatic sensitization. On the other hand one of the other approaches to achieve panchromatic sensitization is by co-sensitization using multiple dyes which have complementary absorption features. TiO_2 is well used semiconductor which was obtained highest conversion efficiency with many of organic dyes up to now. In the present work, we have chosen ZnO as a substrate since ZnO has higher electron mobility than TiO_2 expecting similar or higher performance of the cell compare to that of titania based DSSCs. Metal free organic dye D -358 (Indoline) and black dye are utilized to sensitized ZnO electrode. The maximum photocurrent of 14.1 $mAcm^{-2}$ with the overall efficiency of 3.5% was observed for ZnO/D-358/I_3^-/I^- electrolyte solar cell. An enhancement of absorption of the electrode was observed by coupling of D-358 with triscarboxy-rutheniumterpyridine "[Ru(4,4',4"-$(COOH)_3$-terpy)$(NCS)_3$] (Black dye). The maximum efficiency of 3.7% and 17.1 mAcm-2 of photo current were observed for ZnO/D-358/Black dye/electrolyte solar cell. The enhancement of photo-performances of the cell was explained by acceleration of an extra electron flow toward the ZnO electrode by malty channel charge transfer process. ZnO/D-358/electrolyte and ZnO/Black/electrolyte cells exhibited maximum photocurrent of 14.1 and 10.0 $mAcm^{-2}$ respectively. ZnO/D-358/black/electrolyte cell exhibited the highest photocurrent values much higher than that of other configuration such as ZnO/Black/D-358/electrolyte considered in this study. According to our results a clear enhancement of overall efficiency and photo current were observed due to enhancement of absorption properties of multi-dye electrodes.